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EDITORIAL

An Educational Problem

AT the British Association this year there was read a *paper on the declining intellectual capacity of the* community at large measured by certain specified *standards. Whether the allegation is true or not requires* considerable study by those who are experts in such *matters, but the question is of considerable importance* for in many countries the whole national system is *founded upon an assumption that the majority is* sufficiently intelligent and informed to rule the minority. *It is perhaps merely a coincidence that this supposed* intellectual decline takes place in a period in which *democratic rule has received some rude shocks. During* recent years Italy, Germany, and Austria have come *under the rule of small but powerful bodies whose* ambitions and wishes it is not permitted to criticize. *Freedom of thought and freedom of speech were highly* valued in some countries and are still highly valued *here but they hardly exist in perhaps half Europe.* In this country we are allowed to print almost anything that is not *libellous* and not calculated to promote a breach of the peace and we believe that our newspapers give us on the whole *a fairly* accurate account of *home* and foreign events. It seems to be doubtful whether such *freedom* of expression is *allowed* in some of the foreign countries with whom we were formerly allowed to exchange opinions with considerable ease. In this country for half a century or more we have spent a large and increasing sum of money on a great system of national education; it is now possible for the children of quite poor people to obtain a first-class education, as good an education as is possible for the children of the really rich. This is a very great advantage to the nation and among the poorer classes there are many individuals who deserve to have these advantages. On the other hand the great spread of education has not been accompanied by a noticeable increase in intellectual interest on the part of the public at large. If we judge by the newspapers and journals with the largest circulations we seem to notice a falling-off rather than an increase in information of an intellectual character. A few great daily newspapers do provide us with accurate information about science and literature and other high-brow topics, but many other papers and journals give us the impression that their readers are interested in crimes and divorces, in horses and dogs, in sport of various kinds, and in the fashions, but so small a proportion of the population takes any interest in, say, science that it is not worth while for the publications to include any reliable scientific news; many of them *prefer sensational scientific news to accurate scientific* news. The public at large is not interested in science, or *literature, or art, and another thirty years of our* system of education will not make the public at large *any more interested in these subjects. The fact is that* only one person in a thousand, or perhaps ten thousand, *has enough brains to be able to study chemistry,* or rigid dynamics, or history, or foreign exchanges, or the works of *Mozart*, or Van Eyck, and *no national expen*diture of money on education will materially alter this *proportion. Thirty years ago there were many maga*zines dealing with serious topics, apart from politics: *the Edinburgh, the Quarterly, and so on: to-day the* demand is more for magazines describing the futile *doings of fashionable people in Italy or Scotland.* Thirty years ago there were evening newspapers in London, *the Pall Mall, Globe, Westminster, and others* that always had some articles intended for educated people: *these newspapers have disappeared and there* is but little in the present evening papers, except Stock Exchange prices, betting news, sport, fashions, current news items, and short samples of popular fiction. We do not blame the proprietors or editors of the papers for their selection; their duty is to publish what their readers want and we think they do it. It is a little melancholy to think that their readers in 1933 desire a lower and lighter literary diet than they did in 1903 or 1893. The more people in any country who can read and can afford a penny for a newspaper the lower the intellectual level of the matter that will be published; the greater the circulation the less will be the desire for news about subjects that only one person in a thousand can understand. When we consider how chemists can interest the mass of mankind in chemistry we should bear some of these probabilities in mind. Many countries find that the most urgent problems they have to face involve a consideration of such complicated matters as the gold standard, foreign exchange, the need for exports in order to pay their debts, the need to exclude imports, and the niceties of banking. It is reasonable to suppose that these problems are as difficult to study as chemistry or botany and that not one person in a hundred thousand studies them or is entitled to pronounce a judgment on any proposed alterations in our various systems. In spite of this alterations will be made at the instance of an ignorant democracy or at the instance of an ignorant oligarchy and no one can predict the financial result. It will be interesting to learn six or nine months hence the cost of the experiments—shall we call them research?—in America, Germany, and Russia.

Structural Glass

The Crystal Palace, one of the most amazing structures ever built, demonstrated a great many years ago what could be done with glass as a structural material. Since then our glass industry has had its lean years, happily past let us hope, for to-day glass production has reached a high pitch of excellence. The larger buildings now consist of a skeleton framework of steel filled in with a light-weight panelling for which glass is particularly suitable: it can be made in all thicknesses from an eighth of an inch, a frail enough sheet, to a tough and even armoured material an inch and a half thick. Mechanical methods have gone hand in hand with chemical and technical progress in the glass industry to a state of high efficiency which does credit to all concerned. Some idea of the scientific progress may be gleaned year by year from the collected experimental researches and reports published by the Department of Glass Technology of Sheffield University which in particular includes a summary of the progress of mechanical methods. Sheets of considerable area can be made and bent while hot to simple or compound curves: one side can be textured, that is fluted or made prismatic so as to increase the illumination. Steel wire mesh may be embedded in the molten sheet. Another development is to colour the glass by adding certain oxides or rare metals, whereby the physical and chemical qualities are altered in many ways, giving glasses, for example, which transmit ultraviolet rays, or alternatively filter out the chemical or heat rays. Of interest for food factories and hospitals is a glass in which the light is filtered through yellow or red media, it having been established that flies dislike and avoid places so illuminated. There is an increasing use of glass for internal lining of walls. The toughened glass known as "Armourplate" has quite remarkable properties in being flexible and proof against shock: it is claimed that it will withstand tornadoes and earthquakes. Laminated glass is now a feature of every motor-car, fine glass threads—so called wool—are finding increased use as an insulating medium. Another line of development is the fusion of a form of glass on a metal base, the resulting material combining the strength and flexibility of form of the metal with the smoothness, cleanliness, and other properties of glass. We have stressed these developments of glass to indicate how much research is taking place in the building industry usually accused of being ultra-conservative. To some extent the skyscraper—of which New York alone possesses over two hundred upwards of 24 storeys high—has introduced the desire to save weight and so has brought about the trial of new materials. This is giving the chemist an opportunity to offer a variety of synthetic products, for example, the resins: that there are other developments in store is witnessed by the announcement that Imperial Chemical Industries are about to enter the plaster board trade, in which new use is made of a very venerable material—calcium sulphate. It is said that five thousand million capital is locked up in buildings on which the wear and tear taken only at one per cent. amount to fifty million pounds per annum: this is obviously a field in which the chemist has great opportunities.

Metric Units of Volume

The Chemical Divisional Council of the British Standards Institution has decided that in all British Standard Specifications prepared for use in the chemical industry in which reference to metric units of volume is made, the unit to be employed shall be the millilitre (abbreviation ml.) in preference to cubic centimetre. For example, the millilitre has been adopted as the unit in terms of which British Standard volumetric glassware shall be calibrated, and as the unit to be employed in the description of analytical methods. The decision to adopt this unit was taken after careful consideration involving a detailed study of the history of the metric units of volume and of current practice. A similar recommendation was made by the Joint Committee for the Standardization of Scientific Glassware in 1924 and has since been adopted in many important publications. Some journals, however, still retain the use of "c.c." The British Standards Institution considers that the general use of the millilitre in all journals is highly desirable. This recommendation is one that requires very careful consideration and before we decide to abolish the old "c.c." and put in its place the less familiar "ml." we should like to feel that we are leading British chemists and chemical engineers along a path that they are willing to adopt. Experience has convinced us that to lead an unwilling army, where no means of compulsion are available, may place the leader in a position of rather ignominious isolation: we prefer the more cautious policy of first finding out where the army wishes to be led and then giving the necessary instructions in as authoritative manner that will indicate our own importance and self-satisfaction. We have been familiar with the cubic centimetre and the square metre and the square inch and the pint or half-pint for some considerable time and each of these terms seems to be appropriate to some special set of circumstances: we have no deep-seated preference for the litre as a unit of measure over the cubic centimetre, nor does it seem to ns that it is necessary, having adopted the centimetre as a unit of length, to insist on the square centimetre as a unit of area and the cubic centimetre as a unit of measure. So far as this JOURNAL is concerned we should consider not only the logical use of the metric system and the desire to adopt any reform in procedure that seems to be beneficial: we must also consider the wishes of the community on whose behalf we toil and slave. The practice of the community decides the use of words and the community pays much less respect to authority than it should: it pronounces orator with a short "a" when it should be a long "a": it uses "sense" as a verb and "urge" as a noun in a most reprehensible manner and indulges in slang and flippancy when solemnity and decorum are expected. The language lives and grows and if chemists desire to drop the "c.c." they will drop it and choose a better term. If they will let the editor know their wishes by means of a post-card or a letter, not necessarily for publication, he will give due consideration to all such relevant circumstances and try to find an opportunity of comparing notes with those who direct other scientific journals.

CHEMISTRY AND AGRICULTURE

By Dr. ALEXANDER LAUDER*

A recent president of this section referred in his ..idential address to the fact that while many of his ..ecessors in this chair had been chemists, none of ..m in recent years had taken the relation of chemistry ..griculture as the subject of his address. A glance ..the subjects of the addresses for the past twenty ..rs shows that the presidents who have been chemists ..e confined themselves to general agricultural questions ..to problems of agricultural education or research. .. true that in his address at Toronto in 1924 Sir John ..ssell dealt with "Present Day Problems in Crop ..duction," and in his masterly survey of the progress ..agriculture during the past century, delivered at the ..ntenary meeting of the Association in 1931, he sur..yed the development of agricultural chemistry during ..e century, the treatment in both cases being necessarily ..neral.

The importance of the application of science, particu..rly of chemistry, to agricultural practice has been ..lized for a very long time. In his address to the ..st meeting of this section at Dundee in 1912 Sir ..omas Middleton dealt with this aspect of the subject ..Early Associations for Promoting Agriculture and ..Improving the Improver"). So far as the British ..sociation is concerned, this importance, as we shall .. later, was early realized. As far back as 1839, ..petition to which many influential names were ..tached was presented to the general committee asking ..r the formation of a separate section for agriculture. ..e proposal was rejected however, and for many ..ars there was no direct representation of agriculture; ..ore recently a subsection for agriculture was formed ..ich was attached either to chemistry or botany, ..d the present section was definitely established in ..12.

When the Association last met in Leicester in 1907 ..riculture was represented by two papers presented ..the Chemical Section. One was a discussion on the ..alities of wheat and flour, dealing particularly with ..e strength of flour, and the second on the "Production ..Acid or Alkaline Reactions in the Soil by Manures," ..Mr. A. D. Hall. A glance at the recent programmes ..this section will give some idea of the developments ..ich have taken place since we last visited Leicester.

At the meeting of the Association in Swansea in 1880 ..John H. Gilbert was president of the Chemical Sec..n, and devoted his address to the application of ..emistry to agriculture. He pointed out that not only ..s the application of chemistry to agriculture included in ..title of the section, but that in 1837 the committee ..the section had requested the late Baron Liebig to ..pare a report on the condition of organic chemistry. ..e first part of his report, entitled "Organic Chemistry ..its Applications to Agriculture and Physiology," ..s presented in 1840, and the second part, on "Animal ..emistry or Organic Chemistry in its Application to ..ysiology and Pathology," followed in 1842. It is ..t necessary for me to refer to the far-reaching effects of these reports. As Sir John Russell said in his centenary address, they can "without exaggeration be described as the most important publication in the whole history of agricultural science." Sir John Gilbert went on to point out that in the forty years which had elapsed since the publication of Liebig's reports, no president had taken agricultural chemistry as the subject of his address, and, as I have already pointed out, the subject has generally been avoided during the succeeding fifty years.

Gilbert devoted about a third of his address to an historical introduction and to a detailed description of the new views brought forward by Liebig. He then went on to discuss how far Liebig's views had been modified in the course of time, and to state the conclusions which had been arrived at by recent work on plant and animal nutrition.

As regards plant nutrition, the main problems were the sources of carbon and nitrogen, and the views then expressed by Gilbert are still held without serious modification at the present day. He confirmed the opinion of De Saussure and Liebig, that the greater part if not the whole of the carbon was derived from the carbon dioxide of the air. It is worthy of note in passing that he was greatly interested in the effect of continuous daylight on the carbon assimilation of plants and also of the effect of illumination by electric light, but concluded as regards the latter that the determining factor was the cost, which is still the position at the present day.

He then turns to the difficult question of the nitrogen supply of plants and describes the results obtained at Rothamsted by Lawes and himself. The careful experimental work led to no conclusive results. Summing up the result of the inquiry, Gilbert says that "although the recorded evidence is admittedly very conflicting, we then came to the conclusion, and still adhere to it, that the balance of the direct experimental evidence on the point is decidedly against the supposition of the assimilation of free nitrogen by plants. Indeed, the strongest argument that we know of in its favour is that some such explanation is wanted." The explanation followed some six years later, when the memorable results of the Hellriegel and Wilfarth investigations were published. In the later part of his address he dealt with two questions which were then exciting much attention, viz., the origin of muscular power and the sources of fat in the animal body.

The conclusion arrived at was that the fat of the herbivora is largely produced from the carbohydrates of their ration. As regards the origin of muscular power, he concluded after a careful review, "that all the experimental evidence at command tended to show that by an increased exercise of muscular power there was, with increased requirement for respirable material, probably no increased production and voidance of urea, unless owing to excess of nitrogenous matter in the food or of a deficiency of non-nitrogenous matter, the nitrogenous constituents of the body were drawn upon in an abnormal degree for the supply of respirable material." He concluded his address by stating that "while much remained to be done both in chemistry and physiology as regards the above problems, yet I

* Presidential Address to the Agriculture Section of the British ..sociation for the Advancement of Science on September 7, 1933.

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think we may congratulate ourselves on the re-establishment of the true faith in regard to them, so far at least as the most important practical points are concerned."

I have dealt somewhat fully with the state of knowledge of our subject fifty years ago in order that we may appreciate more fully the changes which have taken place since then. A great deal of the investigations during the past half-century have been concerned with the more accurate and detailed working out of the ideas discussed by Gilbert and his contemporaries and the explanation of many points in agricultural practice which had been evolved by centuries of experience by farmers, and while nothing spectacular in the way of change may have resulted, the cumulative effect of the more accurate knowledge about soils, fertilizers, crops, and nutrition has undoubtedly been important. In addition, several discoveries of fundamental importance have been made: the synthetic manufacture of ammonia and nitrates; the effects of vitamins in animal nutrition; the theory of base exchange in soils; and the development of bacteriology, to mention some of the more outstanding only.

Some of these, although they might be described as advances purely from the scientific side, have yet had practical applications of the highest importance. The theory of base exchange in soils, which may be said to have originated in this country with the early work of Way in the fifties of last century and is associated in modern times with the names of Gedroiz, Hissink, and Wiegner, has provided an explanation of absorption and exchange phenomena and of soil acidity, and has been successfully applied to the reclamation of alkali soils in Hungary (Von Sigmond) and the Western States of America, as well as in the treatment of land recovered from the sea.

Amongst other notable advances which have had a practical application may also be mentioned the use of sulphur for reducing fungoid attacks on crops and for reducing alkalinity in soils, particularly soils used for growing potatoes, and the study of the functions of elements which occur only in minute quantities in plants, *e.g.*, copper, manganese, and boron. The application of modern statistical methods to the interpretation of field experiments and of biological experiments generally has led to a more accurate appreciation of the experimental errors involved, and of the significance attached to any result.

Since the last meeting in Leicester, very real advances have been made in our knowledge of the chemistry of the proteins, carbohydrates and fats, and of enzymes; this has led necessarily to a clearer appreciation of the processes concerned in the synthesis of plant products and of animal metabolism. Among the major problems awaiting solution are the methods by which plants take up their nutrients and the further development of biochemical methods generally.

The Soil

The study of the soil may be approached from two points of view. In the first of these it is regarded as the seat of certain chemical, physical, and biological processes which are investigated entirely from the scientific point of view without any reference to agriculture. This has been the method of attack of [the] Russian school in particular, and the supposition [is] that when a sufficient body of knowledge has [been] accumulated in this way, the consideration of [the] facts obtained may result in practical applications [of] value to the agriculturist: it should be emphasiz[ed], however, that the approach in the first instance is pur[ely] scientific. The interesting volume published a [few] months ago by Prof. G. W. Robinson of Bangor give[s a] clear exposition of the methods of this school and of [the] results which have so far been obtained. The ot[her] method has been to study the soil as the medium of pl[ant] growth, to investigate practical problems as they ar[ise] and to have as its definite aim the giving of advice [to] those engaged in agriculture as to improving th[e] methods of tillage and crop production. It is obvio[us], of course, that no definite division can be made betw[een] the two methods of approach, as is shown by the hist[ory] of recent developments. In this country, while [the] former method has been by no means neglected, witness the large amount of research work carried [out] at Rothamsted and to a lesser degree elsewhere, it [is] the latter method which has been in the main officia[lly] supported and subsidized by successive governments.

Amongst the scientific methods which have emerg[ed] and received considerable prominence and supp[ort] in recent years is the modern method of soil classificati[on]. This, while belonging to the scientific method of inve[sti]gation, also seeks to justify its existence by the cla[im] that it is of immediate importance to the farmer. T[he] method was first developed in Russia, where it w[as] shown as early as 1879 that climate is responsible [for] the great tracts of similar soil found in that countr[y]; this idea was developed by later workers and mo[re] recently by Glinka and others, who recognized so[me] of the limitations of the original method and propos[ed] in place of the earlier zonal type of classification [a] system based on the effect of climate on the developme[nt] of the soil profile. Soils were divided into two gr[eat] groups. In the first were placed the soils in which t[he] profile shows that the external soil-forming process[es], especially climate, have predominated; the seco[nd] group comprises those soils in which the internal proce[ss], *i.e.*, parent material, still predominates. These grou[ps] are further subdivided, but the whole system lays spec[ial] emphasis on the development of the soil profile—that [is,] the vertical section from the surface soil to the u[n]weathered parent material.

Although soil surveys had been carried out for [a] considerable time in Europe and the United Stat[es], modern soil surveying may be said to date from t[he] first International Soil Congress held at Budapest [in] 1909. At this meeting Glinka explained the new meth[od] of classifying and mapping soils on a climatic bas[is] and soil surveys on the new basis were soon begun [in] a large number of European countries and in the Unit[ed] States. At the International Soil Congress held [in] Rome in 1924 it was agreed to construct a soil map [of] Europe, and in 1926 the special committee representati[ves] of the different countries concerned met in Hungary [to] discuss in the field the practical details of the work [on] which the map was to be based. At a subseque[nt] meeting in Budapest, the details of the methods we[re]

...usted, and it was agreed to undertake the construc... of a map of the soils of Europe based on as uniform method of surveying as possible. The "General Map of the Soils of Europe," under the editorship of Prof. Stremme, Danzig, was published in 1927. The English text, translated by Dr. W. G. Ogg, of the Macaulay Institute for Soil Research, Aberdeen, was published in 1929 with the aid of a grant from the Department of Agriculture for Scotland. The first edition of the map is on the scale of 1 : 10,000,000, and preparations for a second edition are in progress.

The idea of a soil map of Europe is an ambitious one and the conception is not without its attractiveness. In the present state of our knowledge however, it appears to many that the plan is possibly premature and that there is a great element of unreality in the results. It is only fair to the editors to say that they fully realize the difficulties of carrying out a survey of this extent on a uniform basis, and admit that the results are imperfect and will require to be modified in various ways. It seems fairly clear however that the difficulties of making such a map have been seriously underrated. Few workers in Europe have any extensive knowledge of soils outside their own countries, with the inevitable confusion as regards classification and nomenclature. At home our soil workers have to be content with spending a few weeks in the field each summer. It is evident therefore that the difficulties are great and that the rate of progress must be slow. At the same time the meetings of workers from different countries at the International Soil Conferences, with the resultant exchange of ideas and experiences, must be valuable in the development of the subject.

Turning next to the methods employed in surveying, the profile is studied as regards horizons, colour and texture changes, structure, drainage, and vegetation. The surface horizons are naturally more extensively studied. As regards the chemistry of the profile, most weight is placed on the ratio of silica to sesquioxides; other factors examined are the presence and accumulation of salts, including calcium carbonate, and changes in acidity with depth. On the results of these observations, the soil is placed in its appropriate class. In passing, it may be noted that there appears to be a certain reluctance on the part of the advocates of these methods to ascertain by means of carefully conducted field experiments whether some of the differences they are mapping are really significant in practice and whether some of the finer differences which they map, between soils within the same type, have any reality and make any appreciable difference in agricultural practice. As regards the utility of soil surveys generally, a reasonable case can be made out for the benefits which are likely to follow a careful survey of a new country which is just being developed. The difficulty there is to provide the staff and funds so that the survey work is kept ahead of the development.

In a country like this, on the other hand, there is considerable doubt on the part of many as to whether the benefits which are supposed to follow such a survey will ever be realized. The question of suitable crop distribution and association is well established as the result of generations of experience and is not likely to be seriously altered as the result of such an investigation. It is claimed that a soil survey on the scale of 1 in. to the mile would be of great importance in connexion with manuring and in the interpretation of the results obtained by the various methods of estimating the available plant nutrients in the soil. Before undertaking a survey of such magnitude, it should be pointed out that such a claim would require to be based on the results of a wider series of accurate field trials than are available at present. At the same time the importance of survey methods from the purely scientific point of view and also in connexion with land-reclamation problems should not be overlooked.

What the farmer wishes to know about his soil is whether it is adequately supplied with nitrogen, phosphates, and potash, and whether there is sufficient lime present to give a satisfactory soil reaction. These are reasonable questions, but it must be admitted that in the past the task of the agricultural chemist who had to attempt to answer them was by no means easy. Much progress has been made in recent years, and although much still remains to be done, more satisfactory replies can now be given to the farmer's questions than was formerly the case. With regard to nitrogen, no method exists by which we can judge the requirements of a soil as regards this element; the fact that most soils respond to dressings of soluble nitrogenous fertilizers is about as far as we can go in the way of prediction.

At the same time it must be pointed out that considerable progress has been made in the difficult question of the nature of the soil organic matter. The recent work of Page in England, Schmuck in Russia, and Waksman in America [S.C.I. Ann. Rep., vol. xvii (1932), p. 461] has shown that the so-called "humic acids" are in all probability protein-lignin complexes. Synthetic products of this type have been prepared and agree closely in properties with the humic acids found in soil organic matter. On the other hand the lime requirement of a soil can now be given with reasonable accuracy by routine methods which are suitable for use on a large scale. The question as to whether the dressing of lime which is theoretically desirable, can be recommended is generally an economic rather than a chemical one. To determine what the requirements of a soil are with regard to available phosphates and potassium is a more difficult matter. The most that can be aimed at at present is to be able to say whether the soil is well supplied or moderately supplied with these constituents, or is deficient in them.

The difficulties of discriminating between the available and non-available constituents in a soil are obvious. In the first place, the way in which plants take up their nutrients from the soil is still a matter of controversy, and the fact that the soil is a heterogeneous and ever-changing system of extreme complexity greatly increases the difficulties. The chemical methods generally employed involve the extraction of the soil with water or some dilute solvent and the estimation of the phosphates and potassium which come into solution under standard conditions. When the results can be interpreted in the light of field experiments or experience, they are a very useful guide in advisory work. The fact that the method is an empirical one is

a great drawback, but the more serious objection is that the results give a measure of the condition of a soil at a particular time only and obviously cannot apply to its condition at different times throughout the year. There is probably no hard-and-fast line between the "non-available" and the "available" constituents, the one set gradually merging into the other.

These fundamental difficulties have suggested the idea of making use of the plant itself as an index to the available plant nutrients in the soil. Much work from this point of view has been carried out, and two methods based on these principles have been in use on the Continent for several years: these are the well-known methods of Mitscherlich and Neubauer. These methods, as well as Wiesemann's modification of Mitscherlich's method, have been very ably and critically reviewed by Dr. R. Stewart in a recent publication of the Imperial Bureau of Soil Science (Technical Communication No. 25, 1932).

Mitscherlich's method is based on his claim to have discovered a law of plant growth which is applicable to all plant species: he claims to have established that the plant yield can be increased by each single growth factor, even when it is not present in minimum, so long as it is not present in maximum. In its original form it was given by Mitscherlich as follows: The increase of crop produced by unit increment of the lacking factor is proportional to the decrement from the maximum. This can be expressed mathematically as follows:

$$\frac{dy}{dx} = C(A - y)$$

where y is the yield, A is the maximum yield, and x the growth factor. (It is interesting to observe that this equation is identical with that for a monomolecular chemical change.) Mitscherlich developed an elaborate technique for applying his theory to the testing of soils by means of pot experiments. Here again, certain arbitrary assumptions had to be made, *e.g.*, as regards the depth of sampling, the effects of the subsoil, and the permeability of the subsoil. These assumptions regarding the sampling factor undoubtedly raise serious difficulties and have been the subject of adverse criticism. From his estimation of the manurial content of the soil, Mitscherlich then calculates the manurial requirements, the calculation being greatly simplified by the assumption of the constancy of the effect factor, which means that the manurial requirements for any one soil are the same for all crops.

Mitscherlich's method has been subjected to severe criticism—first, on his theoretical assumptions, his treatment of his experimental data and the applicability of the logarithmic law; and secondly, on the constancy of the "effect factors." Notwithstanding these criticisms, Mitscherlich had such faith in the usefulness of his method that he has developed stations in different parts of Germany for testing soils by his methods. The Soil-Testing Society in East Prussia had in 1931 no less than five stations, and the number of pots in use was 25,000, equivalent to 2500 soils tested. The original cost of a test was £5—£6, but this has been very much reduced in later years. This is direct evidence, at any rate, of the belief of the practical farmer in the value of the test. It is satisfactory to know that an installation of Mitscherlich pots has been set up at the Macaulay Institute for Soil Research at Aberdeen and that in addition a large series of field pots has been laid down on different types of soil according to the Mitscherlich plan. It will be interesting to see what agreement is found between the results of the tests and the results obtained by laboratory methods of extraction.

The Neubauer method, on the other hand, depends on the estimation of the nutrient content of the soil by the growth of young seedlings. The method depends on the absorption of phosphates and potassium by plants in the early stages of their growth. By adopting a standard technique and using rye seedlings as his crop Neubauer proved that the amount absorbed was constant for a given sample of soil. By using a large number of seedlings and by diluting the soil with sand he considered that the phosphates and potassium taken up by the seedlings would represent the total available supply of nutrients in the soil. This would give the nutrient content of the soil without any reference to the manurial requirements of a particular crop, the estimation of this being the same problem which is met with in all chemical-extraction methods of analysis.

Having determined the root-soluble nutrients in this way, the next problem was to calculate from the figure obtained the manurial requirements of the various crops. To do this he makes two main assumptions: (1) that under the conditions of the test the seedlings absorb the total quantity of available phosphates and potassium and (2) that crops under field conditions can utilize only a certain fraction of the total amounts present owing to the different conditions of growth. Making the above assumptions and estimating the quantities of phosphate and potassium removed by the various crops, he then calculates the "limit values" for the various crops. In order to calculate the amount of fertilizer to be applied to soils showing less than the "limit values," he again assumes that only 60% of the potash applied and 20—33% of the phosphates are available during the year of application.

Neubauer's method has also been subjected to considerable criticism on the analytical details, the influence of external factors, and the determination of the "limit values." The analytical work concerned requires a high degree of accuracy, and possibly some of the criticism of the method has been based on results obtained without sufficient care having been taken in the analytical work.

The question of practical interest is, how do the results obtained by the two methods agree, and which method is the more reliable as to the manurial requirements of a particular soil and crop? Neither of these questions is easily answered. It may be said at once that there is a wide divergence between the figures obtained and yet, applying the different standards of the two methods, it is claimed that there is a good agreement in both cases between the results of field trials and the recommendations of the methods. It should be pointed out that the method of comparison is purely qualitative, *i.e.*, if a deficiency of potassium

been indicated by the test and there is a response a dressing of potassium salts in the field, this is taken case of agreement.

One general difficulty which applies to both methods that they can be carried out only at institutes specially equipped for the purpose. The Mitscherlich method requires a whole season to carry out the test, while the Neubauer requires much supervision and extreme accuracy in the analytical work. Attempts have therefore been made to devise simpler biochemical methods suitable for the ordinary laboratory use; of these, two are of special interest.

The Azotobacter method.—*Azotobacter chroococcum* is a well-known soil micro-organism which has the power of fixing soil nitrogen, and its use as a method for testing soils was first worked out in Denmark. The organism is very sensitive to acid conditions, and this was used as the basis of a method for measuring the "lime requirements" of a soil. This method has been superseded by the more convenient and more accurate physico-chemical methods now employed. In addition to requiring a non-acid medium, the rate of growth of the organism depends also on the supply of phosphates, and later the method was adopted for the estimation of the available phosphates in the soil. The defect of the method is that there is no accurate means of estimating the development of the bacteria and that the results are therefore only qualitative in character.

The Aspergillus method.—The principle of this method is the same as that described above, but it has the advantage of being more quantitative in character, as it is possible to collect the fungus and weigh it. It was found that under standard conditions the growth of *Aspergillus niger* is proportional to the amounts of available potash and phosphates in the soil. The mould is grown in a suspension of the soil in a culture solution containing all the constituents necessary for growth except the one being tested for. The mixture is inoculated with the organism and incubated for four to six days. During that time the mycelium develops and covers the surface of the liquid like a felt. It is then removed, washed, dried, and weighed. The estimations are carried out in triplicate or quadruplicate, and the results of a large number of experiments have shown that the standard error is of the order 4%. The particular strain of organism employed and the form in which the nitrogen is supplied are important factors in the success of the determinations.

The method has been worked out by Prof. Niklas and his colleagues at the Agricultural Research Station at Weihenstephen, near Munich, and has also been subjected to a critical examiuation by Dr. A. M. Smith, Edinburgh, who has tested the method with a variety of Scottish soils, as well as investigating the effect of different sources of nitrogen on the process.

The results obtained by this method have been compared with those obtained by Neubauer's method, and have shown on the whole very good agreement, especially for potassium. The richer the soil as estimated by the Neubauer method, the greater the growth of *Aspergillus*. For phosphates the agreement between the two methods is very good as far as poor soils are concerned, but is only moderately good for the intermediate or richer soils; one difficulty is that the absorption of phosphates by the fungus is not constant for different types of phosphates.

The Aspergillus method is therefore likely to be valuable in estimating the potassium and phosphate requirements of a soil. The results, as might be expected, are more reliable for potassium than for phosphates, and while not rigidly quantitative, give information as to whether the soil is rich or poor in these constituents. It has the advantage of being rapid and requiring no expensive apparatus (A. M. Smith and R. Coull, Scot. Journ. Agr., 1932, **15**, 262).

The whole question of available plant food is necessarily bound up with the complex relationship which exists between plant and soil, and it is unlikely that any simple or single method will be devised to overcome the inherent difficulties of the problem and be generally applicable to different sets of conditions. The admitted lack of agreement obtained with the various methods at present in use is undoubtedly due, to a large extent, to the variety of factors involved, as well as to the fundamental objections which may be raised to any one method. We are still very ignorant of the process of assimilation by the growing plant, and until we have more information on this subject, methods of estimating availability must continue to be largely empirical and the results merely first approximations.

The usual method of approach to the problem has been to study the effect of the soil or plant medium on the plant. In Edinburgh attention has in recent years been directed in the opposite direction—namely, to a study of the effect of the plant on the soil. The alterations to be observed are, of course, small, but by applying methods which might almost be described as analogous to modern micro-methods of analysis, measurable changes can be followed with considerable accuracy. The results which have been obtained are interesting and sometimes rather unexpected, and although it is scarcely to be supposed that they will furnish a complete picture of the relationship between soil and plants, one feels that any contribution to the subject from a new angle may be of value in the study of such a complex problem.

Fertilizers

Turning next to the progress which has been made in the manufacture and use of fertilizers since the time of Gilbert's address, there are one or two notable dates and achievements to be mentioned.

In 1878 Thomas and Gilchrist introduced their new basic process for the manufacture of steel which resulted in the production of basic slag as a by-product. It was a few years before the value of the slag as a source of phosphates for plants was discovered. The importance of the new slag in agriculture was first realized in Germany. The earliest experiments in this country were carried out in England by Wrightson and Munro in 1885, and by A. P. Aitken in Scotland about the same time; a year or two later J. J. Dobbie carried out the first experiments with the slag in North Wales.

The now classic experiments laid down by Prof. Somerville in 1896 and carried on and developed by his successors, Sir Thomas Middleton and Prof. Gilchrist,

have demonstrated the value of this addition to phosphatic fertilizers and show as the result of twenty-five years' experiments that basic slag is for certain types of soil even more valuable than superphosphate. Changes in the modern methods of steel making and the effect of the large amount of scrap iron and steel available in the years succeeding the war brought about a considerable alteration in the composition of the slags produced in this country. About ten years ago therefore the Ministry of Agriculture and Fisheries set up a permanent committee on basic slag, "to consider the development and improvement of the manufacture of basic slag and the extension of its use." This committee has produced a valuable series of reports, the last (tenth) report being published in September, 1932. The work of the committee has been, in general, "to make a detailed study of the agricultural values of the slags now available to farmers and the chemical means by which these values can be expressed." By means of the old but empirical citric acid test, the slags produced n this country can be divided into two groups—a high-soluble group in which 80% or more of the phosphoric acid is soluble in 2% citric acid, and a low-soluble group in which less than 40% is soluble. The experiments in recent years have been carried out with hay, and while no final conclusion can be drawn at this stage, the results indicate that with this crop the high-soluble slag showed, in the first year, a slight superiority over superphosphate and a marked superiority over mineral phosphate and low-soluble basic slag, and there was in addition a considerable improvement in the quality as well as the quantity of the hay obtained from the more active phosphatic fertilizers. The figures obtained for the recovery of phosphoric acid were interesting. For two years the recovery of phosphoric acid added were superphosphate 12%, high-soluble slag 9%, mineral phosphate 4%, and low-soluble slag %.

Pot experiments with barley carried out from 1927 to 1931 gave similar results, the high soluble slags giving better results even than superphosphate on certain types of soil (*e.g.*, Millstone Grit) and markedly better than the low-soluble slags.

It must always be borne in mind that basic slag is a by-product and that its composition may be altered by changes in the methods of steel manufacture. The need for the work of such a committee is, therefore, obvious and the committee should be continued.

The beneficial effects of mineral phosphates as fertilizers was noticed as far back as 1845. New sources of material and improvements in the methods of grinding have led to a great extension of their use in recent years.

Superphosphate.—Improved methods of manufacture and better sources of raw material have led to a progressive improvement in the quality of this fertilizer. In 1907 the total world production was 7,813,570 metric tons, and in 1930 this had been almost exactly doubled (15,582,162 metric tons). There has, of course, been a fall since then, but this is due very largely to the prevailing depression. Formerly, superphosphate was considered an acid manure and its continued use was supposed to deplete the soil of lime and to increase its acidity. A large amount of experimental work has been carried out in recent years, and the result is to show conclusively that the objections to the use of the so-called physiologically acid manures have been the result of misconceptions or possibly even misrepresentations. The use of superphosphate does not generally increase the acidity of the soil.

Nitrogenous fertilizers.—Attention has already been directed to the far-reaching effects of Liebig's reports to the British Association in 1843 and 1847. In the year 1898 the Association was again to take a prominent part in the development of agriculture. The president that year was Sir William Crookes, who devoted his address to showing that if the rate of increase then assumed of the world's population was correct, the world would be faced with a wheat famine in the not far distant future. He pointed out also the necessity, if we were to increase the production of wheat, of the increased use of ammonium salts and nitrates as fertilizers. As regards nitrogenous fertilizers, he showed that we were living on our capital of combined nitrogen compounds and that there was also the danger of a nitrogen famine to be faced. The remedy he suggested was to devise methods for "fixing" or bringing into combination the nitrogen of the atmosphere, and he actually sketched methods and estimated costs of effecting this combination by electrical means. As far back as 1784 Cavendish had shown that oxygen and nitrogen could be made to combine under the influence of the electric spark. Many years were to elapse, however, before a practical commercial method was evolved. The earlier methods were electrical in character and were developed in Norway and Italy, where cheap supplies of electrical energy were available. These methods have been more or less superseded, and ammonia is now manufactured by a synthetic method on an enormous scale at the works of the Imperial Chemical Industries, Ltd., at Billingham. The method used is a modification of the Haber-Bosch process. The practical difficulties which had to be faced were great; of these I need only mention the problem of working at pressures of over 200 atmospheres—*i.e.*, over 3000 lb. per sq. in.—and at an elevated temperature, to enable you to realize some of the difficulties which had to be overcome. The successful development of the method is certainly one of the greatest triumphs of chemistry and engineering in modern times. By this process, which incidentally dispenses with the use of sulphuric acid, sulphate of ammonia can now be prepared more cheaply than from gas liquor where the ammonia is obtained as a by-product.

By the oxidation of ammonia to nitric acid by means of a suitable catalyst ammonium nitrate can be prepared, and by mixing this with calcium carbonate a valuable fertilizer, known commercially as "nitro-chalk," is manufactured.

Concentrated complete fertilizers.—One of the most interesting developments of the synthetic ammonia industry has been the manufacture of concentrated complete fertilizers containing nitrogen, phosphates and potash in suitable proportions and all soluble in water. The basis of these fertilizers is a mono-ammonium phosphate which is made by subjecting finely ground rock phosphate to the action of a mixture of sulphuric

and ammonium sulphate. This gives directly a ...tion of mono-ammonium phosphate containing a ... ammonium sulphate and calcium sulphate is ...cipitated. The mono-ammonium phosphate contains ...2% nitrogen and 61·7% phosphoric acid, and is ...s a highly concentrated fertilizer. By mixing this ...h ammonium sulphate and a suitable potash salt, a wide range of fertilizers can be obtained. The ingredients are finely ground and then passed to a special ...orporator in which they are churned by means of paddles, whilst saturated steam is blown in. In this way, granules are formed which are then dried: roughly, one ton of such fertilizers supplies as much plant food as two tons of the ordinary mixed fertilizer of similar composition. They possess the obvious advantage of reducing freight and handling charges and cost of distribution to the land: they are granular in texture and very easy to sow, and they can be stored without risk of deterioration: further, the constituents are all soluble in water.

Another point claimed in their favour is that they contain little except the three fertilizers, nitrogen, phosphates, and potash, while the ordinary fertilizers contain appreciable, and in some cases large, amounts of calcium, sulphur, and other elements. It is possible that in some soils the absence of the additional substances might be a disadvantage, and a careful comparison of the new fertilizers with the old mixed fertilizers will be necessary to show that no disadvantage attends the use of the new compounds over a number of years. Accurate field experiments on a wide variety of soils were carried out in this country in 1930 to compare the relative effects of the concentrated complete fertilizers and of mixtures of sulphate of ammonia, superphosphate, and potash giving the same amounts of nitrogen, phosphates, and potash. With the three crops examined (oats, potatoes, and sugar beet), the concentrated fertilizers gave the same average increases in yield as the equivalent ordinary mixtures. At certain centres, however, the concentrated fertilizers gave better results and at others a poorer yield than the ordinary mixtures. The work is being continued. It is obvious that if the concentrated fertilizers were used continuously over a number of years, increased attention would require to be given to liming.

(To be continued.)

PRACTICAL "TEST" MANIPULATION

HANDLING THE CUPELLATION FURNACE

By C. C. DOWNIE

Although recent years have seen wide developments in most metallurgical processes, the actual refining of silver on the "test" or cupellation furnace does not appear to have altered very materially. The design of the hearths employed has, however, been improved to some extent whilst greater latitudes are to-day permissible in working comparatively impure argentiferous leads.

In earlier years it was customary to see that the lead to be transferred to the "test" was first refined and put through at least two cleaning processes. The first consisted of a low-temperature skimming whereby most of the copper was removed, followed by a high-temperature skimming which removed the bulk of the tin and antimony present. The method of conducting the cleaning of the lead has varied from time to time but the principle remains practically the same. Of recent years increased attention to platinum metals has altered this practice. In the "test" furnace any iridium which is present in the silver-lead tends to sink to the bottom and becomes imbedded in the bone-ash of the hearth. This also applies to a smaller extent to other elements of the platinum group.

Greater care is therefore accorded nowadays to the making of the hearths on account of the small amount of very precious metal which is likely to be recovered. The lead cleaning process is varied for the same reason. Where the works conditions permit, it has been found most satisfactory to remove the bulk of the iridium etc. during the skimming process. In this way, although the silver-lead to be cupelled contains platinum and palladium it appears to be practically free from the heavier constituents which sink to the bottom of the "test." This process was made possible by the work of D'Hennin, who first recovered iridium from goldsmiths' sweepings by the addition of arsenic, and later developed it to the treatment of argentiferous leads. On skimming the lead, the skimmings contain the iridium whilst the cleaned lead is practically free from this metal. The platinum present is divided between the skimmings and the lead, but the bulk of it usually remains in the lead. Platinum does not sink into the bone-ash of the cupellation hearth as does iridium, and thus the action of the arsenic serves a useful purpose. Prior to the introduction of the D'Hennin process, the lead containing all the platinum metals present was handled on the "test." It was then necessary to carefully scrape the bottom of the hearth and closely examine all disused bone-ash, since these precious constituents had concentrated therein.

Since the D'Hennin process was adopted, it has become unnecessary to take such stringent precautions, although as a safety measure it is usual to return all material scraped off the top of the hearth, after use, to one of the refining furnaces. All old bone-ash is later collected in a heap and passed on to the blast furnace where it becomes fluxed, and the minute content of precious metal picked up by the lead.

DETAILS OF THE HEARTH

The cleaned lead from the skimming process is conveyed to the test house in the form of pigs on small bogies. It contains anything from 10% to 20% of silver. Should the cleaning process concentrate the silver beyond this figure, the lining of the cleaning furnace would tend to absorb an appreciable amount of silver, as, unlike the cupellation furnace, the hearth is of large dimensions, and further, is lined with firebrick. The "test" used to-day in many quarters is much the same in design as those described in most metallurgical literature, but they are if anything more compactly constructed and supplied with a blast from a positive blower, as opposed to the fan type of blower. The ratio of grate area to hearth area is considerable, whilst the fumes evolved escape to the condensers. Instead of depending on a natural draught which might raise

a variable temperature, it is better to have a water-seal attached to the grate and use a forced draught. The earlier practice of using natural draught, and depending on manipulation of the damper to secure the necessary temperature is still in use.

The hearth is circular and comparatively shallow, and sits on a bogie with wheels underneath. This bogie with the freshly lined bone-ash hearth is run into position, bolted tight, and any slight crevices filled in with fireclay. The hearth is raised to a bright red heat, and several pigs of lead added. After this lead has reached the desired temperature, a blast of cold air is caused to impinge on the surface of the mass which forms a scum of litharge on the surface. The bogie used for running the hearth into position is removed and substituted by another bogie on which is fitted a conical-shaped mould to act as a receptacle for the molten litharge as it flows from the hearth. A hole is made in the hearth, practically in line with the surface of the molten lead, but prevented from overflowing by a notch of fireclay. The furnace attendant periodically opens this notch and allows the molten litharge to flow down to the conical mould below.

Once the litharge has formed properly, further pigs of argentiferous lead are added, and thus the process goes on until the concentration of the silver has reached a fixed degree. If desired, the concentration could be carried on until the final product is silver, but it is more customary to use two "test" furnaces. In this way the first or "roughing test," may be of fairly large dimensions, which permits of the argentiferous lead being rapidly and safely reduced to concentrated condition, whilst the litharge recovered is of a poor quality and may be used up for odd purposes.

Systematic Concentration

The "roughing test" raises the silver content of the lead up to about 60% in some cases, although this figure is varied widely in different works. This rich silver-lead is then cast into small pigs, which are transferred to the "silver test." The capacity of this hearth is only about 6000 oz. (about 4 cwt.).

The same process of blowing cold air on to the molten surface of the metal is continued, but the litharge this time is richer in silver and is returned to one of the refining furnaces for recovery of the silver contained. Prior to the final stage of cupellation a small sample of the metal is taken and assayed. This is done so that the result is obtained before the cupellation process has been completed. When working with silver from a variety of ores and residues etc. it happens that some are free from gold etc. and on completion of the process it is only necessary to cast it into bars. In order to recover the gold and platinum present in most crude silver, the electrolytic process has become very popular within the past twenty years. In some works, if the assay of the metal in the "test" shows 0·03% of gold or more, it pays to cast the resulting silver into anode moulds for subsequent electrolysis.

Too much copper in the argentiferous lead tends to cause the bone-ash hearth to crack. Additions of pure lead plates, or plates containing silver and no copper, are made. In this way the cracking is largely prevented, as lead and copper oxidize with almost the same ease and under almost the same conditions. The presence of much copper shows itself by altering the colour of the litharge, and this indication tells the furnace attendant to add excess lead. The litharge also becomes more sluggish and requires a higher temperature to melt it. Researches on the relative amounts of iron, nickel, tin, antimony, arsenic, and copper removed in the litharge at different stages have been dealt with elsewhere, and need not be elaborated on here. The argentiferous lead charged contains as a rule, anything up to about 8000 oz. of silver per ton, or more. This contains about 300 oz. of gold, 20 oz. of platinum, and about 1 oz. of palladium per ton. When cast into plates for the electrolytic process, the assay shows from 80% to 95% of silver, and from 5% to 20% of gold, whilst the platinum ranges from 60 oz. to 300 oz. and palladium about 30 oz. per ton.

PHARMACEUTICAL TRADE IN BULGARIA

In the course of the last few months an increasing number of foreign merchants, including several English firms, has been tendering offers in Bulgaria for pharmaceutical wares that have hitherto been supplied only by Germany. A report recently published by the Commercial Board of Vienna, reproduced here in extract, will therefore be of interest.

The production of biological preparations sera, vaccines, anti-toxins, and the like is exclusively entrusted in Bulgaria to the State Institute for Bacteriology, Sofia; private production is strictly forbidden. The Institute produces all kinds of sera necessary to subdue the epidemics so frequent in this country, but it can provide no more than is required by the public hospitals and infirmaries, and private practitioners must get their requirements from abroad. For import of foreign biological products a licence has to be obtained from the High Medicinal Board for National Health, each separate consignment being specially controlled by the State Institute for Bacteriology. Each consignment is carefully inspected before being handed over to the receiver and great care is taken to ascertain that the contents are in strict correspondence with the official declaration on the label. If this control is passed, the Institute for Bacteriology may still reject a consignment, so that all parties concerned are well advised to inquire closely into the provisions of the import control that have been established in the last three years, the regulations being exceedingly strict in so far as new preparations are concerned. The preparations coming from abroad are sera for tetanus, diphtheria, streptococca, meningococca, pneumococca, and some vaccines, anti-toxins, and other preparations specially produced by certain firms; of all these preparations only the two first enumerated are imported in large quantities.

In former times articles of this description were for the most part supplied by Germany, a small amount only coming from the Public Serotherapeuthic Institute of Vienna, and imports of French origin were insignificant. During last year's typhus epidemic in Sofia, French firms made big efforts to provide the indispensable sera, but the medical profession, for the most part, declined to use French products.

REMOTE ELECTRICAL VALVE CONTROL

Of great importance to the chemical and allied industries is efficient remote control of valves for the supply of steam, gas, compressed air, water, and acids and other liquids. In this connexion considerable interest attaches to the "Copes" electric Thrustor-operated Type B.I. control valve, which is supplied by Copes Regulators Ltd., of London (5—11, Theobald's Road, W.C.1).

The arrangement consists of the firm's special design of control valve, suitable for any gaseous or liquid medium, and the "B.T.H." electric-hydraulic "Thrustor," a production of the British Thomson-Houston Co., Ltd., Rugby, forming a compact self-contained unit which includes a small electric motor operating an oil impeller and piston, controlled from any distance by means of a connecting wire supplying the current so as to open or close the valve as required.

Generally for this purpose either a motor with gear drive or a solenoid has hitherto been used. The latter has the inherent disadvantage of "slamming" the valve, that is, a sudden operation is given as contact is made and broken. Gear drive also from a motor is slow, and in both cases sticking is apt to take place because of the use of a sliding stem for the valve. It is claimed however, that the "Copes" control unit is free from these troubles.

Copes "Thrustor" control valve

The essential feature of the control valve is operation by a horizontal rotating shaft at the top which is constantly in the stuffing box, and not by a sliding valve stem. As a result much less friction results, partly owing to the smaller movement, an important point for distance control work, while no dirt penetrates into the stuffing box.

For example, a detailed test showed that the friction of a $\frac{3}{4}$-in. sliding valve stem was 36 lb. under the conditions of 335 lb. pressure and a reasonably tight stuffing box. As against this the friction for a "Copes" rotating valve stem was only $\frac{1}{2}$ lb. with a total movement not exceeding $\frac{1}{16}$-in. The "B.T.H." electro-hydraulic "Thrustor," embodying a small A/C or D/C motor, is entirely self-contained with no valves or external piping and exerts a smooth straight line constant pressure thrust on the valve control with no possibility of sticking.

In general the principle is that of a centrifugal impeller driven by the motor working in a closed cylinder containing oil. When the motor is switched on the impeller forces the oil from an upper to a lower chamber giving a steady thrust on the piston which operates the lever of the horizontal rotary valve control. On switching off the motor returns to the "rest" position, and so on. The valve itself is of the high lift type with either standard "rectangular" or "V" ports available in a large number of sizes, while the rotary spindle operates on the "balanced" principle with a weight on the lever.

CANADIAN MINING

The production of non-ferrous metals in Canada in 1932 showed a total production value amounting to $161,957,930, a decline of 24% during the year. The 445 plants operated in 1932 employed a monthly average of 29,059 persons.

The Dominion Bureau of Statistics at Ottawa, in its preliminary report on the statistics for 1932 relative to "Manufactures of the Non-Metallic Minerals," estimates a production value for the year of $150,611,853, a decline of more than $30,000,000 during the twelve months. The figure quoted represents the output of more than 1000 plants, with total capital of $317,000,000. The greatest decline was suffered by the cement industry.

The Geological Survey Branch of the Dominion Department of Mines at Ottawa has just issued a new edition of Map 155A, which is of particular importance as it shows the greater part of the mining area of Northern Ontario, including the Sudbury nickel-copper mining area, the Kirkland Lake and Porcupine goldfields, the Cobalt and South Lorrain silver mining area, and the iron mining region north of Sault Ste. Marie. A copy of the map can be consulted at Canada House, Trafalgar Square, London, S.W.1.

The Consolidated Mining Smelting Co. of Canada, Ltd. is now bagging high-grade native silver and argentite, as well as pitchblende ore, mined on its claims adjoining those of Eldorado Gold Mines, Ltd., at Great Bear Lake. The pitchblende showings are not yet extensive, but the fact that the company is able to make small shipments is regarded as significant.

The mineral industries of Canada have been showing decided improvement this year, following the depression caused by industrial conditions. Tangible results are already in evidence. The International Nickel Co., formerly operating at 20% of rated capacity, has increased production of copper-nickel matte to approximately 40%. Its Creighton mine has been re-opened, and the rate of output at the Frood mine has been increased to 100,000 tons a month. At the Port Colborne (Ontario) refinery the company is now operating five of its nine electrolytic circuits. Base Metals Mining Corporation, Ltd. is making active preparations to re-open its Monarch property, at Field, British Columbia, which has been idle since 1930, and other plants are showing increased production.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICE

Associate Members. A new form of associate *membership is now in force at a yearly subscription of* 7s. 6d. A copy of the Annual Reports on the Progress of Applied Chemistry is supplied instead of the JOURNAL but in many respects the benefits of full membership are provided. The age limit is 23. Full particulars may be obtained on application to the General Secretary, 46, Finsbury Square, London, E.C.2. Members are *particularly requested to encourage their young friends* to graduate into full membership by this means.

CORRESPONDENCE

VEGETABLE PARCHMENT FOR FOOD WRAPPING

SIR,—I *have noted with interest that* Mr. James Strachan, on behalf of British Vegetable Parchment Mills, Ltd., thinks my statement before the meeting of the Food Group of the Society of Chemical Industry at Blackpool, namely, that vegetable parchment is *commonly treated with a deliquescent and its presence* is always to be expected, may have been true "fifty years ago." He might have added that it has been also true since then, and he does not claim that it is, *in general*, untrue to-day; he does add that "vegetable *parchment to-day is the purest product of the paper* industry," which is clearly unprovable and as it may be.

The manufacture of vegetable parchment in this country is, of course, very recent: in no sense is it any exclusive index of the industry as a whole. On the *Continent its manufacture is older and larger and some* of its products can and do come into use in this country *as soft parchment for the wrapping of foodstuffs. Soft* vegetable parchment is commonly treated with a deliquescent to ensure pliability, and its presence is always to be expected even if—as Mr. Strachan emphasizes—it is not invariably present. In one important country the Dairy Association adopted as a standard Ash 3, Water Soluble Extract 8, Sugar 8%, which, as far as I know, is still in force: in our own country I have personal knowledge that, within the past two years, a vegetable parchment containing magnesium chloride has been offered for sale and recommended for use as a food wrapping.

I believe, therefore, in spite of what Mr. Strachan says, that all interested in the wrapping of foodstuffs will be well advised to continue expecting to find deliquescents present in soft vegetable parchment. Let us hope, simultaneously, that their expectations may be unrealized, more and more in the course of time.

I am, Sir, etc.,
CHAS. J. J. FOX

Lincoln's Inn,
London, W.C.2
Sept. 20, 1933

SIR,—It is to be regretted that Dr. Fox attempts to defend his statement, which has been given wide publicity, to the effect that various deliquescent substances such as glucose, magnesium chloride, glycerin, etc. *may be expected as a normal constituent of vegetable* parchment which is used for the wrapping of foodstuffs.

I must therefore state authoritatively that from the point of view of not only the consumer in this country, but in various export markets where we are competing actively with foreign vegetable parchment mills, the *statement made by Dr. Fox is to-day **generally** untrue.* The position may be summarized briefly in stating that when "vegetable parchment" is ordered by any consumer he is supplied with a hard-neutral sheet composed of pure parchmentized cellulose without *any addition whatever of sizing, loading, or softening* material. If however, for the purpose for which the parchment is to be used it is desirable to have a softening agent present, the parchment is ordered and specified as "soft vegetable parchment" or "half-soft vegetable *parchment,*" and generally both the nature and the percentage of the softening materials allowed are specified.

The quantity of "soft vegetable parchment" containing deliquescent materials made at the present day *is a very small percentage of the total, and it is used* only for special purposes outside the food industries. Not only in England but in the principal butter-producing countries (which consume over 90% of the world's total production of vegetable parchment), the use of such *softening agents as glucose and magnesium chloride is* absolutely vetoed. As I have already pointed out in a former communication, those softening materials were introduced in the early days of parchment manufacture when it was found necessary to use the same for increased *pliability of the sheet. This is no longer necessary* to-day, when the degree of pliability can be obtained for food-wrapping without this addition. The only exception to this general rule is the case of one or two food-packers who specify a definite very small per*centage of glycerin for a special purpose.*

The above statement is well substantiated by Mr. Paul Arup ("The Analyst," March, 1931, pp. 149—161) *in a paper on the "Analysis and Composition of Vegetable* Parchment Used for Packing Dairy Products." Mr. Arup obtained from the various sources available 33 different samples of vegetable parchment, 15 of which were procured from manufacturers or their agents under the *description of* "vegetable parchment." The other 18 samples were taken from deliveries made to various creameries. In the 15 samples obtained from parchment manufacturers the average water-soluble extract was in the neighbourhood of only 1%, and not one of these samples *contained* softening materials. In the other 18 samples, with one exception, the water-soluble extract was of the same order as the others. The exceptional sample, one out of 33, was definitely, from the analysis, a "half-soft parchment," containing 7% of water-soluble matter, which from the food-packer's point of view must be regarded as an adulterant.

As a result of Mr. Arup's analyses of 41 samples of vegetable parchment he suggested that the maximum water-soluble extract of vegetable parchment should be fixed at 1·3%.

Previous to the publication of Mr. Arup's paper, several very large consumers had already fixed this figure on *a slightly* lower basis, but the *suggestion* made by Mr. Arup to fix the maximum at 1·3% has received favourable consideration on the part of not only many consumers, but also manufacturers.

The principal use of vegetable parchment is for the wrapping of butter, margarine, and lard, which industries consume over 90% of the world's production of this material. In Denmark, Australia, and New Zealand, from where we obtain the bulk of our butter, the use of softening agents is strictly forbidden in the manufacture of parchment, and it cannot be too widely known that in the packing of foodstuffs generally the addition of such softening agents must be regarded as an adulterant of the wrapping of any class of foodstuffs unless specially required for a specific purpose, as the presence of deliquescent substances in parchment has been proved definitely to be a very important, if not the predominant factor in the development of mould growths. In short, what the suspicious chemist expects and looks for in the laboratory is usually the reverse of what the consumer expects in normal vegetable parchment.

We have now been manufacturing vegetable parchment on a very large scale in these mills for 6 years, and wherever requested we supply a complete analysis of our parchment, and guarantee that this is representative of our delivery, and we believe that Continental manufacturers generally are quite prepared to do the same thing.

I am, Sir, etc.,

JAMES STRACHAN

Director and General Manager
for the British Vegetable Parchment Mills, Ltd.

Northfleet,
Kent

Sept. 25, 1933

A COLLOID CORRELATION PRINCIPLE

SIR,—*The above principle*[1] *can be exemplified as* follows :

Examples of operation

Occurrence	Initial colloid system (a)	Successive colloid system (b)	Life tendency of particle size (a)	Life tendency of particle size (b)
(1) Ocean expanses	FOAM	SOLID SALT PARTICLES (nuclei) IN AIR	Smaller to larger	Smaller to larger or larger to smaller. (depending on dispersion)
	D.M. liquid (*e*) D.P. *gaseous*	D.M. gaseous (*f*) D.P. solid		
(2) Some volcanic eruptions	HOT FOAM (*before emission*)	VOLCANIC DUST*	Smaller to larger (*creating explosion* and eruption)	Smaller to larger or larger to smaller (depending on dispersion)
	D.M. liquid (lava) (*e*) D.P. gaseous	D.M. gaseous (*f*) D.P. solid		
(3) Experimental ..	SMOKE	SOLID AGGREGATE [see (ii)]	Smaller to larger	Stationary
Stage (i)	D.M. gaseous (*f*) D.P. solid	D.M. solid (*d*) D.P. gaseous		
	SOLID AGGREGATE [see (i)]	DUST (on applying air current)	Stationary	Larger to smaller
Stage (ii)	D.M. solid (*d*) D.P. gaseous	D.M. gaseous (*f*) D.P. solid		

D.M. = Dispersion medium.
D.P. = Disperse phase.

N.B.—(*d*) wherever D.M. is *solid*, life tendency is a minimum.
(*e*) ,, ,, liquid ,, smaller to larger.
(*f*) ,, ,, *gaseous* ,, *either smaller to larger* or larger to smaller.

* The structure of many volcanic dust units shows them to have formed the walls of gas cells before eruption (Geikie's Text-book of Geology).

The above diverse cases show the active operation of the principle in the transformation of certain natural colloid systems into their successors. The underlying natural process seems to be the inversion of the rôle of dispersion medium and disperse phase once or more in succession with corresponding life tendency scope changes.

Summing-up the conclusions in previous communications, together with the above, the following formulations can be made :

1st principle or law.—In colloid systems, when the natural process is dominant, the units of the disperse phase will tend to grow either larger or smaller at rates varying with the system. This life tendency of particle size varies directly in scope with the mean free path of the dispersion medium molecules (*i.e.*, whether medium is *solid, liquid, or gaseous*). When *solid*, the scope is a minimum, life tendency having unidirectional, restricted, smaller to larger operation. When liquid, *the scope is medium, life tendency proceeding* unidirectionally from smaller to larger. When gaseous, the scope is a maximum, life tendency proceeding either *smaller to larger or larger to smaller.*

2nd principle or law.—Whenever a colloid system, whose dispersion medium and disperse phase are initially of different physical state, is inverted to form a succeeding colloid system, there is always an accompanying parallel change in the life tendency of particle size of the disperse phase.

I am, Sir, etc.,

Co. Durham

S. C. BLACKTIN

Sept. 11, 1933

[1] CHEMISTRY AND INDUSTRY, April 28, 1933, pp. 372—373.

"MODERN FOOD PROBLEMS," AND ANOTHER

SIR,—Thank you for publishing the letters of Messrs. *Whittaker and Cannon to take our minds for a few* moments off more serious matters. I am sure you, Mr. Editor, will agree with me that a man would look an awful fool running to his mother every time he wanted a drink ! And *is* there more in Mr. Cannon's letter than meets the eye, or is it really what we were taught

umpty-three years ago as first year—or maybe second year students

I sincerely apologize to your two correspondents for this undoubtedly misplaced "humour" but I can't help it. Perhaps the "silly season" has affected us all.

I am, Sir, etc.,

Liverpool E. GABRIEL JONES

Sept. 23, 1933

LEAD-LINED PLANT AND CHEMICAL STONEWARE

SIR,—Certain of the statements made in the article "*Lead-lined Plant and Chemical Stoneware*" in your issue of September 22 might have been allowed to pass without comment as irresponsible but for the fact that its sponsors are so important a body as The British Chemical Plant Manufacturers' Association, and also that great satisfaction is expressed with the results obtained, so much so that it is proposed to initiate similar investigations in the future.

In pointing out that the heating up of stoneware must be done with great care since brittleness is a characteristic inherent in all stoneware, it is stated that British-made stoneware is superior in *many* respects. Since only one specific property, that of resistance to heat is in question, the claims made on behalf of British ware are vague and unconvincing.

The definite statement that the glaze on chemical stoneware was *frequently* more porous than the stoneware itself is perfectly absurd. All glazes, it is true, have a certain porosity, but very delicate apparatus is necessary to detect it, and for all practical purposes any normal glaze may be considered as absolutely non-porous.

The remark that the glazes used on *many* foreign stonewares contained objectionable amounts of iron, and the obvious inference that British manufactured ware was, in comparison, relatively free from the metal, is incorrect. Three distinct types of glaze are used for chemical stoneware: (1) the salt glaze, (2) a felspathic glaze of the porcelain type, and (3) the so-called slip glaze, which is a natural fusible clay. All types contain iron, the salt glaze from about 2% to 8%, the felspathic under 1%, and the slip glaze about 8%. Curiously enough the chemical resistance of the slip glaze is very high in spite of the iron. Practical experience has demonstrated that the presence of iron in glazes used on stoneware is not objectionable and can be ignored providing the composition, in other respects, is satisfactory.

It is incorrect to say that stoneware should in no case have a porosity greater than 1%, and that a *much* lower figure could be obtained. It is customary for chemical stoneware manufacturers to supply various grades of material, having very different porosities, *i.e.*, for certain purposes a porosity of 12% is desirable. Any manufacturer who could consistently supply large chemical stoneware plant with 1% porosity would have every reason to be satisfied, but I very much doubt if this is possible of attainment.

I hold no brief for foreign stoneware—in fact quite the contrary.

I am, Sir, etc.,

Leeds MAURICE BARRETT

Sept. 25, 1933

PERSONAL AND OTHER ITEMS

We regret to learn of the death on September 23 of Mr. J. B. Orr, a well-known member of the Liverpool Section of the Society. Mr. Orr was one of the original members of the Society, and was the founder of Orr's Zinc White Works in Widnes. A full obituary notice will appear in a later number of the JOURNAL.

We regret to announce the death, as the result of an accident on September 14, of another member of the Liverpool Section, Mr. W. Bottomley, who was associated with the United Alkali Co. for some years. He retired from the post of chief engineer of the Widnes works of Imperial Chemical Industries eighteen months ago. Mr. Bottomley had been a member of the Society for nearly thirty years.

A well-known member of the Society, Dr. R. B. Forster, leaves England next month to take up the appointment of head of the new Department of Chemical Technology in the University of Bombay. Dr. Forster has been lecturer in colour chemistry in Leeds University for the last fourteen years. He will be succeeded in this post by Mr. E. J. Cross who has been an assistant lecturer at the University for some years.

We regret to learn of the death of Mr. P. Rintoul, deputy-chairman of Stewarts and Lloyds, Ltd., chairman of Coltness Iron Co. and Bacares Iron Ore Mines, Ltd., and director of many other companies.

Dr. G. Barsky, who has served as chief technologist of the American Cyanamide Co., has resigned from his position as director of the company's experimental laboratory, Linden, N.J., in order to take up general chemical consultative work. Dr. Barsky, who has been a member of the Society for several years, has published a number of papers on subjects connected with industrial chemistry and metallurgy.

We regret to learn of the death on September 4 of Mr. Evans McCarty, who was for many years vice-president of the United Lead Co. of America and a director of several other companies manufacturing pigments.

We regret to record the death on September 19 of Sir Alexander Clegg, proprietor of Bowen & Co., brass founders, in whose works the first cast aluminium cooking utensils were made in this country. He was a director of the Linoleum Manufacturing Co., Ltd.

We regret to record the death recently of Dr. Herbert Lapworth, the noted engineer and geologist. Dr. Lapworth was an authority on geology in its application to civil and especially waterworks engineering. He served on several technical committees and was at one time secretary of the Geological Society.

Dr. Herbert E. Ives, who is to deliver the Thomas Young Oration before the Physical Society at the Royal Institution on October 6, is well known to physicists for his work on photometry and calorimetry. In recent years he has been responsible for many developments connected with photo-electric problems.

Institute of Fuel

In the last issue of the JOURNAL it was stated that Dr.-Ing. H. Koppers would be unable to present his paper entitled "Recent Developments in Coking Practice," and that other arrangements had been made

holding the meeting. Matters have now been ...asted however so that Dr. Koppers will be able to ...sent his paper as originally planned. It will be ...en, therefore, on October 18, at 2.30 p.m., at the ...ological Society's Rooms, Burlington House, Picca- ..., W.1. Dr. F. S. Sinnatt will be in the chair.

University of Sheffield

The University of Sheffield has recently been pre- ...ted by Sir Robert Hadfield with a cheque for £5000 ... commemorate the second visit of the Iron and Steel Institute to Sheffield. Sir Robert was president of the Institute at the time of its first visit in 1905. Whilst ... University is free to use the money as it desires, ... Robert hopes that it will be used for furthering ...tallurgical research.

The Coal Utilization Council

A meeting of the Coal Merchants' Federation of Great Britain recently agreed unanimously to a proposal to pay a levy not exceeding one-eighth of a penny on every ton of coal bought for inland sale. With the help of this levy and a similar one which it is proposed shall be contributed by colliery owners, the Coal Utilization Council will be provided with £60,000 annually to be spent in developing the home market. In addition to direct sales-promotion activities, a research organization is contemplated, which will work in conjunction with existing organizations.

The League of Industry

The second annual conference of the League of Industry is to be held at Buxton, from September 29 to October 1, when Sir William Morris and other leading employers of labour will be among the speakers. Subjects which will be discussed include the hours of labour in industry, Japanese competition in the cotton industry, and the economic position of the heavy industries. The League aims at promoting the interests of employers and employed; it has 2000 branches in industrial establishments.

Oil from Coal

A scheme drawn up by Prof. G. Knox, Dr. R. Illingworth and Mr. M. H. Merrett, providing for the production of oil from coal in one hydrogenation plant and ten low-temperature carbonization units has recently been placed before the Industrial Development Council of South Wales. After approving the scheme the Council decided to refer it to a committee of scientific, financial, and commercial experts to find ways and means of bringing it into being. The total cost of the scheme is £7,000,000 and it is estimated that the plants would produce 40,000 tons of light oil, 240,000 t. of heavy oil, ...,000 t. of pitch, 2,520,000 t. of smokeless fuel and ...220,000,000 cb. ft. of gas, and the plants would consume 4,000,000 t. of coal annually. The operating costs of the combined plants is estimated at £1,475,000.

The Zinc Cartel

It is stated in Holland that the International Zinc Cartel has decided to go into dissolution following disagreement on the method of distributing fines levied for production in excess of quotas. It was understood that the cartel was exteuded for a year from August last, but if a new agreement is not reached the cartel will dissolve on October 31.

Tees-side Industrial Development

During the past few months there has been a considerable increase in industrial activity on Tees-side, and some mention of the developments contributing to this activity is made in a News Bulletin issued by the Tees District Development Board, of Lloyds Bank Buildings, Middlesbrough. In addition to the erection by Imperial Chemical Industries, Ltd. of the plant at Billingham for obtaining oil from coal, The British Titan Products Co., Ltd. are erecting a works for the manufacture of titanium pigments; Cleveland Steel Casements, Ltd. is transferring its works to Middlesbrough: Head Wrightson & Co., Ltd. have commenced at Thornaby-on-Tees the manufacture of stainless steel studs used in road construction; Ashmore Benson, Pease & Co., Ltd. have commenced the manufacture of welded steel poles for electric transmission lines, and other well-known firms are increasing production. The suitability of the area for factories is well dealt with in an illustrated pamphlet issued by the Board, the text being given in English, French, and German.

The Autumn Fair at Vienna

The Vienna Autumn Fair, which was held recently, was a decided success, and was attended by many foreign visitors, several English firms being represented amongst the visitors for the first time. The sale in chemicals showed improvement on previous years' sales, with interest especially in pharmaceutical specialities. The recent commercial treaty between Austria and Hungary led to increased trade in fertilizers.

The 27th Prague Fair

The number of exhibitors at the Prague Fair this year was 2576, an increase of more than 20%, which is a fair indication of the success of the Fair. Visitors came from the United States, France, Poland, Scandinavia, Palestine, and Great Britain. Sales of chemicals have been better than last year and good trade has been done with soap and medium-priced perfumery.

Association of Technologists of the River Plate

The second ordinary meeting of the Association of Technologists of the River Plate was held at the English Club, Buenos Aires, on August 8, when a paper was read by Mr. Edgar Berry, A.M.I.E.E., on "Atomic Weights."

Mr. Berry dealt with the early work of Prout and Stas, followed by that of Dumas and Dobereiner. The fact that the quantity of every element which entered into combination was either a certain definite and unchangeable weight or multiple of that weight, led chemists to believe that the weight of a combining proportion of an element was in some way associated with its physical nature. The first step in explaining this was made by Dalton with the atomic theory, which assumed that all matter was built up of extremely small particles and it was between these particles that union occurred. This conception was developed by Mendeleeff, who published in 1869 a list of elements so grouped that their chemical properties were periodic functions of their atomic weights. Repeated efforts had since been made to render atomic weights in whole numbers, but it was now believed that they were not exact multiples. Later work had shown that nearly

all elements had several atomic weights—lead, for instance, having 16, running from 201 to 216.

Rutherford had now broken the nitrogen atom into three atoms of helium and two of hydrogen. With beryllium it had been shown that when the entry of an alpha particle was effected, a proton or neutron was expelled. Anderson had photographed the tracks due to particles charged positively and, with mass equal to that of an electron, observed that out of 1300 tracks of cosmic rays, 15 had such positive charges. The neutrons constituted a new element of atomic weight zero; this new element should exist in interstellar space in fairly large quantities. The ether might consist of closed combinations of an electron and proton in neutralization, the energy of which, measured from the sum of secondary radiation of cosmic rays, equalled energies of 10^6 to 10^{10} electron volts, and the temperature of annihilation of matter worked out at about 10,000,000,000° C.

Notes from Holland

A factory at Volendam has recently begun to produce artificial hair as a filling material for seats. The product is manufactured from a Mexican grass, and is treated to render it insect- and mould-proof. It resembles horsehair, but is stronger.

A new building material is now being manufactured from the waste sugar-cane fibre received from the Dutch East Indies. The fibre is bound with a cement to produce a material of sp. gr. 1·18. The South Dutch Molasses and Spirit Factory at Bergen is now producing amyl-, isobutyl-, and *n*-propyl acetate.

The N.V. Philips works at Eindhoven are manufacturing plastic products "Philit" and "Marpressit," which are similar to bakelite. The company has also evolved a new photoelectric cell, employing a cæsium salt, which is sensitive to red light. A new lamp has also been produced which is suitable for road-lighting. It is known as the Philora sodium lamp, and it gives off a soft yellow light which does not affect the eyes as other lights do, whilst the cost of current is low. It is already in use at Croydon, in England. Other lamps are being manufactured for lighting rooms, one, the "Bi-Arlita," having a double-spiral of tungsten wire. In its manufacture the tungsten wire is wound on a core of molybdenum, which is afterwards dissolved by an acid.

The firm of Pieter Schoen & Son at Zaandam is manufacturing two new fireproof paints, Tornol and Tornulose, which are also resistant to the attacks of acid, ammonia, and sulphur dioxide. A silicate-paint known as "Porcella" is being made by J. L. H. Smit & Co. at Amsterdam, but this does not appear to have the same fire-extinguishing properties. "Tealux" is a quick-drying lacquer; it is dust-dry in less than an hour, and hard in six hours, and the hardening process continues after that time, whilst one coat gives a satisfactory cover. It is heat-resistant up to 200° C., and is not affected by boiling water, spirits, mineral oils, etc.

A special form of carbon called "Activit" is being produced by the N.V. Activit of Rotterdam for use in water purification. The material will remove ammonia from distilled water, and when used in drinking-water plants, the water is made completely odourless and tasteless.

The Dutch Steel Works, Ltd. at Utrecht is producing a new corrosion-resistant alloy, "Coronit." Its usefulness is shown by the fact that in a comparison with a manganese steel used for a fan for pumping acid water in The Hague, it was unaffected after 3000 hours' use whilst the manganese-steel fan was rendered useless.

Experiments have been made by the firm of Koning & Bienfait at Amsterdam to increase the wearing capabilities of concrete by adding carborundum. The hardness was actually enhanced 100%, and the process should have a definite application for the concrete used for steps. It was also found that the carborundum-concrete possessed anti-slip properties, even when used for garages and factories in which it came into contact with oil.

Notes from India

Indian Institute of Science.—The work of the Indian Institute of Science, Bangalore, is dealt with in the annual report for 1932—33, which has recently been issued, and the report shows that some important results have been obtained.

Mr. A. V. V. Ayengar conducted experiments with a view to producing a cheap substitute for the costly tree-killers now used for killing diseased plants, and showed that a preparation containing arsenic and an alkali is fully as efficacious as preparations on the market costing twice as much.

The ordinary diet of the Indian is rich in organic acids and salts which may react with the metals of the vessels in which the foods are cooked and stored. The significance of any such action is being investigated by Mr. N. C. Datta and Mr. Rangaswamy. Other matters being investigated include the preparation of essential oils from some indigenous plants, and a thorough investigation of Travancore minerals. Some work of agricultural importance has been conducted on the sandal-wood tree, and Mr. M. Sreenivasa has shown the possibility of obtaining immunity to "spike disease" by innoculation with sub-lethal doses of infective material.

A Science Advisory Board in America

A Science Advisory Board has been formed in America by President Roosevelt to give advice to the Government on technical problems arising in the course of administration. The members, who are appointed for two years, include W. W. Campbell, president of the National Academy of Science, Washington, I. Bowman, chairman of the National Research Council, J. C. Merriman, of the Carnegie Institution, Washington, and a number of prominent indnstrialists. The Board has chosen as its chairman Karl T. Compton, president of the Massachusetts Institute of Technology.

Development of Potash and Bromine Industries in Palestine

The Palestine Potash Co. is reported as proposing a further increase in capital (*Die Chemische Industrie*) to develop the output of potassium salts and bromine from the Dead Sea. Special concessions have been granted for the import of chemical plant for this purpose free of duty.

REVIEW

LEHRBUCH DER CHEMISCHEN TECHNOLOGIE. By H. Ost. 18th ed., revised by B. Rassow. Pp. viii + 912. Leipzig: Dr. M. Jänecke, Verlagsbuckhandlung, 1932. Paper, 19 rm.; bound, 19·80 rm.

A book which has passed through eighteen editions, the last of which was out of print within two years of publication, requires no recommendation by a reviewer. The famous author, Dr. Ost, died in June, 1931, and the work of continuing it has passed into the hands of Prof. Rassow of Leipzig. There is but little change: in the main the individual chapters have been brought up to date, a few have been entirely re-written. The book has swollen somewhat in size in consequence and the index has been improved.

The chemist in industry is often a specialist yet every chemist at one time or another is expected to have exact knowledge in every single branch of chemistry and to answer questions of some complexity, which to his credit he usually succeeds in doing. Such omniscience would be impossible without text books and chemical dictionaries and it is probable that where chemical technology is concerned, nothing can supplant Ost as a handy book of reference. The reviewer has tested it by looking up a variety of subjects, generally to find a reference which is concise, accurate, and adequate to help the reader to go forward.

All branches of chemical industry pass under review. It would be an attractive theme to establish the progress in each subject since the first edition of Ost was published; and as further progress is made one can look forward with confidence to faithful chronicles in the succeeding editions of Ost-Rassow. E. F. A.

COMPANY NEWS

BRITISH ALUMINIUM CO., LTD.

The company has announced a dividend of 6% per annum on the preference shares for the six months ended June 30, 1933. The directors are awaiting the full year's trading results before considering payment of a dividend on the ordinary shares. No interim dividend was paid last year on the ordinary shares.

THE COPPER DEVELOPMENT ASSOCIATION

The Association was incorporated on September 12 as a company with offices at Thames House, Millbank, London, S.W.1. The association has three honorary presidents, Sir Harry McGowan, Sir Auckland Geddes, and Mr. A. Chester Beatty; it will be controlled by a council under the chairmanship of Mr. D. Owen Evans, M.P. The management committee, which will conduct the detailed business, has as its chairman Mr. H. D. Clarke, and its members represent most of the important copper interests, including trade associations. It is stated that the association intends for the present to concentrate on developing extended uses of copper rather than on research work.

CANADIAN CELANESE, LTD.

The company has declared a dividend of $1·75 per share on the 7% cumulative participating preferred stock, for the quarter ended September 30.

MARKET REPORT

This Market Report is compiled from special information received from the manufacturers concerned.

Unless otherwise stated, the prices quoted below cover fair quantities net and naked at sellers' works.

The following alterations in prices are reported since the publication of the last Market Report (cf. CHEM. & IND., Sept. 1, 1933, p. 702).

PHARMACEUTICAL AND PHOTOGRAPHIC MATERIALS

Iron Quinine Citrate, B.P.—10½d.—11¼d. per oz., according to quantity.

Quinine Sulphate.—2s. per oz., for 100-oz. tins, tins free.

Sod. Barbitonum.—13s.—15s. per lb.

Sod. Benzoate, B.P.—1s. 9d.—2s. 3d. per lb., according to quantity.

Zinc Stearate.—1s. 3d.—1s. 8d. per lb.

ESSENTIAL OILS

Almond.—Foreign S.P.A., 9s. per lb. Anise.—2s. 1d. per lb. Bergamot.—7s. per lb. Bourbon Geranium.—24s. 3d. per lb.

Citronella Oil.—Java, 2s. 4d. per lb. Ceylon, 2s. 3d. per lb. Clove.—90/92%, English, 4s. 3d. per lb.

Eucalyptus, Australian B.P., 70/75%.—1s. 2d. per lb. Lavender.—Mont Blanc, 38/40%.—16s. per lb. *Lemon.*—5s. per lb. *Lemongrass.*—4s. per lb. Orange, Sweet.—6s. 6d. per lb. Otto of Rose.—Anatolian, 33s. per oz.; Bulgarian, 45s. per oz. Palma Rosa, 8s. per lb.

PATENT LIST

The following is a list of complete specifications of chemical interest which are open for inspection under Section 91 (4) (a) of the Patent Acts. Printed copies are not available, but photographic copies may be obtained at a charge of 8d. per page (minimum 1s.) from the Patent Office, Chancery Lane, W.C.2.

I. 6197 (1933). Babcock & Wilcox, Ltd. Pressure vessels.

24,577 (1933). Austerweil and Jeanprost. *See* VII.

III. 7097—7100 (1933). Schering-Kahlbaum A.-G. Manufacture of unsaturated ketones.

7191—3 (1933). I. G. Farbenind. Manufacture of 4-aminodiphenylamine derivatives.

IV. 7352 (1933). Du Pont de Nemours & Co. Manufacture of vat dyes of the dibenzanthrone series.

V. 823 (1933). Brit. Bemberg, Ltd. Manufacture of artificial silk.

6566 (1933). Steimmig. Production of alkali cellulose for viscose manufacture.

6965 (1933). Brit. Celanese, Ltd. Manufacture of crêpe fabrics.

VI. 21,498 (1932). Lejeune and Bongrand. Facilitating penetration of latex into textile materials.

6919 (1933). Soc. Chem. Ind. in Basle. Dyeing of wool.

VII. 24,577 (1933). Austerweil and Jeanprost. Preparation, separation, or purification of salts, salt solutions, and other solutions.

IX. 2979 (1933). Lacau. Emulsions for surfacing roads.

X. 18,061 (1932). Mauclet. Production of iron-carbon alloys.

6817 (1933). Verein. Stahlwerke. Manufacture of steels and alloy steels.

6860—1 (1933). Fansteel Products Co. Hard alloys.

7092 (1933). Verein. Stahlwerke. Production of articles having wear-resisting surface and of tough core.

XI. 6519—20 and 6665 (1933). Philips' Gloeilampenfabr. Electrolytic cells.

XIII. 7244 (1933). Celluloid Corp. Manufacture of articles from thermoplastic materials.

XIV 21,498 (1932). Lejeune and Bongrand. *See* VI.

XV 6813 (1933). 6813 (1933). Thalheimer, Thalheimer, and Hirschheimer. *Producing a wood glue.*

XIX. 7371 (1933). Feremutsch. Conversion of milk and cream into butter.

XXI. 7335 (1933) I. G. Farbenind. Sensitizing silver halide emulsions.

XXII. 6742 (1933). Wache. Explosives.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the *Department and stating the specific numbers. Australia*: Carbons for lightning arresters (A.Y. 11,979). *British West Indies (Trinidad)*: Casing for oil wells (308). *Canada*: Diesel engines (315). *New Zealand*: Air compressors (321). *Poland*: Asbestos, lubricators (332).

Import Duties Advisory Committee

The Import Duties Advisory Committee gives notice of applications for addition to the Free List of (i) nickel mass (*consisting substantially of nickel hydroxide and* graphite), and (ii) cadmium mass (consisting substantially of finely-divided metallic cadmium and iron partially oxidized).

Any representations should be addressed in writing to The Secretary, Import Duties Advisory Committee, Caxton House (West Block), Tothill Street, Westminster, London, S.W.1, not later than October 16, 1933.

A Survey of the Gas Industry

The Summer Number of West's Gas, published by West's Gas Improvement Co., Ltd., of Manchester, is a fine production containing a large amount of information on the gas industry in this and other countries. Sir David Milne-Watson has contributed an article on the British gas industry and its future possibilities, and many other experts have written articles on the industry in their own countries. The journal has brought together information from all parts of the world, and all those concerned with gas production will find it pleasant and interesting to read. The many excellent aerial photographs alone form a guide to current practice in factory design and lay-out abroad.

Electric Furnaces

Wild-Barfield Electric Furnaces, Ltd. has recently published a leaflet as a supplement to its publication CTO 233 dealing with forced-air circulation in furnaces. The new leaflet describes a tool-room tempering equipment and should be of interest in those workshops where a high degree of accuracy in heat treatment is required. The new equipment is compact and occupies little floor space, and is fitted with automatic temperature control, *temperature indicating instrument*, and complete switch panel with pilot lights.

The company has also published a brochure dealing with its box-type electric furnaces employing "heavy hairpin" heating elements. These elements are of 80/20 nickel-chromium, formed in the shape of a hairpin with the ends thickened to reduce resistance and avoid risk of overheating. The brochure gives a number of excellent illustrations of the design of these furnaces, *with some typical installations.*

Copies of both publications can be obtained from Elecfurn Works, North Road, Holloway, London, N.7.

Monel Metal in Filtration

Monel metal in the form of finely woven Multiplex or Hollander cloth finds many applications in leaf filters. *One such application is the* "*Easifilt*" *filter* manufactured by Manlove, Alliott & Co., and which is described in the July issue of *The Nickel Bulletin*. The filter consists of a cast-iron body combining a number of *elements fitted with Monel metal screws*; these elements can be easily withdrawn and the filter cake quickly detached. An interesting application of filters of this sort is to the process of dry-cleaning by cyclic filtration, *the complete unit for which, manufactured by* Manlove, Alliott & Co. was mentioned in CHEM. & IND., April 28, 1933, p. 370, and is described in some detail in this issue of *The Nickel Bulletin*. It can be obtained from the Mond Nickel Co., Ltd., Thames House, Millbank, London, S.W.1.

PUBLICATIONS RECEIVED

WATER POLLUTION RESEARCH. SUMMARY OF CURRENT LITERATURE. *Vol. VI, No. 8. August, 1933. Abstracts* Nos. 899—1031. Department of Scientific and Industrial Research. Pp. 253—288. London: H.M. *Stationery Office*, 1933. 2s.

CRYOSCOPY OF SOUTH AFRICAN MILK. By L. Denis-Nathan, M.Sc., Ph.D. Union of South Africa. Department of Agriculture. (Division of Chemistry Series No. 128.) Science Bulletin No. 119. Pp. 24. Pretoria: Government Printer, 1933. 3d.

JOURNAL OF THE BRITISH WOOD PRESERVING ASSOCIATION. Edited by A. H. Lloyd and R. C. B. Gardner. Vol. III. Pp. vii + 111. London: British Wood Preserving Association, 1933. Price to Non-members, 7s. 6d.

HANDBUCH DER BIOLOGISCHEN ARBEITSMETHODEN. Edited by Prof. Dr. E. Abderhalden. ALKALOIDE. By Prof. Dr. R. Seka. (2nd Supplement of Section I, Part 9.) Abt. 1, Chemische Methoden, Teil 11, Heft 6. *Lieferung* 417. Pp. 1069—1424. Berlin and Vienna: Urban & Schwarzenberg, 1933. 19 rm.

MODERN THERMODYNAMICS BY THE METHODS OF WILLARD GIBBS. By E. A. Guggenheim, M.A. With a Preface by F. G. Donnan, C.B.E., F.R.S. Pp. xvi + 206. London: Methuen & Co., 1933. 10s. 6d.

A SHORT MANUAL OF SYSTEMATICAL QUALITATIVE ANALYSIS: BY MEANS OF MODERN DROP REACTIONS. By Prof. Dr. C. J. Van Nieuwenburg and Miss Ir. G. Dulfer. Pp. 88. Amsterdam: D. B. Centen's Uitg. Maatschappij (N.V.), 1933. Fl. 3.75.

AN INTRODUCTION TO PHYSICAL CHEMISTRY. By F. B. Finter, M.A. Revised edition. Pp. xv + 276. London: Longmans, Green & Co., 1933. 6s.

TWELFTH ANNUAL REPORT OF THE SECRETARY FOR MINES, FOR THE YEAR ENDED DECEMBER, 1932, AND THE TWENTY-FIFTH ANNUAL REPORT OF H.M. CHIEF INSPECTOR OF MINES FOR THE SAME PERIOD, WITH A STATISTICAL APPENDIX TO BOTH REPORTS. Mines Department. Pp. xx + 236. London: H.M. Stationery Office, 1933 3s. 6d.